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ABSTRACT

This issue brief discusses the statistical results of the 1997 Survey of Doctorate Recipients (SDR) and identifies doctorate holders' employment preferences at the beginning of their doctoral education and labor market experiences. (YDS)

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Division of Science Resources Statistics

ISSUE BRIEF

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NATIONAL SCIENCE FOUNDATION
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EMPLOYMENT PREFERENCES AND OUTCOMES OF RECENT SCIENCE AND ENGINEERING DOCTORATE HOLDERS IN THE LABOR MARKET

Overall, 39.5 percent of employed recent doctorate holders obtained employment in a sector different from what they most desired when beginning their doctoral programs.

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The labor market experiences of recent science and engineering (S&E) doctorate holders are in marked contrast to their preferences at the beginning of their doctoral education according to data from the 1997 Survey of Doctorate Recipients (SDR).[1]

In 1997, there were 582,100 domestically-educated S&E doctorate holders in the United States. Some 119,300—20.5 percent —were "recent" doctorate holders,[2] having completed their degrees between June 1990 and June 1996. The vast majority of U.S. doctorate holders were employed. Unemployment rates in 1997 were only 1.2 percent for all doctorate holders and 1.3 percent for recent doctorate holders.[3]

Employment Setting

Overall, 39.5 percent of employed recent doctorate holders obtained employment in a sector different from what they most desired when they began their doctoral programs. At the beginning of their doctoral programs, 61.0 percent of the 114,800 employed recent S&E doctorate holders recalled most wanting to work in a college or university upon completing their degrees (table 1). In April 1997, 47.8 percent actually were employed in academia with 14.4 percent as postdocs.[4] Another 24.3 percent most wanted to work in business or industry at the beginning of their doctoral program; 31.8 percent were found to be working in private, for-profit companies in 1997. About 9.2 percent of recent S&E doctorate holders were working for Federal, state or local governments while only 4.1 percent most wanted to work in these sectors at the beginning of their doctoral programs.[5]

The wide gap between the most desired and actual sector of employment of recent doctorate holders is more evident in some disciplinary fields than others. For employment in colleges or universities, this gap widens to 20 percentage points or more in the fields of computer/information sciences, mathematical sciences, physics/astronomy, civil/architectural engineering, electrical/computer engineering and mechanical engineering. For example, 70.9 percent of the recent physics/astronomy doctorate holders most wanted to work in academia but only 42.3 percent did so, with 19.8 percent as postdocs. In many disciplines, the proportion of recent doctorate holders who wanted to work in government was much lower than the proportion that had such employment in 1997. For example, in psychology, only 2.0 percent most wanted to work in government, but 11.8 percent were working in this sector.

Recent biological science doctorate holders were in one of the few fields that had a relatively narrow gap between those who most wanted college or university employment (75.1 percent) and those who actually

[1] The data in this Issue Brief are primarily based on two sets of questions in the 1997 SDR. The first set of questions asked respondents to think back to when they began their doctoral program and choose whether or not they would like to do certain kinds of work, and also asked them to choose the employment setting in which they most wanted to work upon completing their doctorate. These responses were then compared to the actual work activities and employment sector of the principal job reported by the respondents as of April 1997.

[2] The 1997 SDR questionnaire asked respondents to report whether they received their first U.S. doctoral degree between June 1990 and June 1996; those indicating 'yes' to this question are defined as "recent doctorate holders" throughout this Issue Brief. All data cited in the Issue Brief are based on this subsample, applicable only in 1997.

[3] Some 2.5 percent of recent doctorates were out of the labor force in 1997. Also, see the Data Brief, *Healthy Economy Yields Even Lower Unemployment Rate for Doctoral Scientists and Engineers*, NSF 99-340, http://www.nsf.gov/sbe/srs/databrf/db99340.htm.

[4] For more information about recent doctorate holders employed in academia, see the Issue Brief, *Academic Employment of Recent Science and Engineering Doctorate Holders*, NSF 01-332, http://www.nsf.gov/sbe/srs/issuebrf/nsf01332/start.htm.

[5] The distribution of recent S&E doctorate holders across the employment sector of their principal job in 1997 did not differ substantially from those of all S&E doctorate holders.

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Recent doctorate holders who obtained jobs in their most desired sector were more somewhat likely to be satisfied with their doctoral programs and their jobs than those who did not.

Table 1. **Desired versus actual sector of employment for recent S&E doctorate holders: 1997**

Field of doctorate	Total, employed recent S&E doctorate holders	College/university[1]				Business/ industry[2]		Government (Federal & state/local)		Other sectors[3]	
		Most desired	Actual[4]			Most desired	Actual[4]	Most desired	Actual[4]	Most desired	Actual[4]
			Total	Not on postdoc	On postdoc[5]						
		Percent									
Total, science and engineering	114,800	61.0	47.8	33.4	14.4	24.3	31.8	4.1	9.2	10.6	11.3
Sciences	90,800	65.0	53.2	36.5	16.7	18.8	24.2	4.1	9.5	12.2	13.1
Computer and mathematical sciences	8,500	74.9	50.7	44.0	6.7	21.5	38.3	S	4.1	2.7	6.9
Computer/information sciences	4,000	63.9	37.9	35.1	S	31.7	53.3	S	S	S	S
Mathematical sciences	4,500	84.8	62.1	51.9	10.2	12.3	24.9	S	S	S	9.0
Biological and agricultural sciences	26,700	73.0	64.5	29.9	34.6	18.9	17.5	3.8	10.1	4.3	7.9
Agricultural/food sciences	2,700	62.2	54.1	38.5	15.7	25.9	32.3	S	8.2	S	S
Biological sciences	23,200	75.1	66.4	28.6	37.8	18.2	15.7	2.7	9.7	4.0	8.2
Environmental life sciences	800	50.2	46.2	38.9	S	S	S	S	26.7	S	S
Health sciences	5,600	69.5	59.5	53.0	6.5	13.3	12.9	7.1	11.9	10.2	15.7
Physical and related sciences	19,700	56.8	41.7	24.7	17.0	36.2	43.0	4.9	8.8	2.1	6.5
Chemistry, except biochemistry	9,800	41.3	35.9	21.1	14.8	54.4	53.0	S	5.0	S	6.1
Earth/atmos/ocean sciences	3,200	74.8	58.5	40.3	18.2	11.0	20.4	11.3	12.9	S	8.3
Physics and astronomy	6,800	70.9	42.3	22.5	19.8	21.5	39.1	5.5	12.4	S	6.2
Social sciences	14,200	79.4	65.2	61.4	3.9	4.9	12.1	6.9	9.1	8.8	13.6
Economics	3,500	71.7	54.1	52.8	S	9.8	19.4	9.2	11.1	9.2	15.3
Political and related sciences	3,300	73.6	63.0	60.4	S	S	S	14.3	14.7	S	14.2
Sociology	2,100	89.4	79.4	74.6	S	S	S	S	S	S	12.5
Other social sciences	5,300	84.2	68.4	62.5	5.9	S	13.3	S	5.7	10.1	12.5
Psychology	16,100	42.1	36.9	30.1	6.8	9.8	19.5	2.0	11.8	46.1	31.8
Engineering	24,000	46.1	27.3	21.6	5.7	45.1	60.5	4.1	7.8	4.7	4.4
Aerospace/aeronautical engineering	900	50.3	S	S	S	37.5	59.4	S	S	S	S
Chemical engineering	2,600	29.8	20.5	10.8	9.8	65.5	68.2	S	S	S	S
Civil/architectural engineering	2,300	60.4	37.9	31.0	S	27.6	42.0	S	13.7	S	S
Electrical/computer engineering	7,100	42.8	21.3	19.5	S	50.4	70.5	S	6.0	4.3	S
Mechanical engineering	3,500	50.2	28.5	25.5	S	41.4	63.7	S	S	S	S
Materials/metallurgical engineering	2,500	32.4	21.4	11.3	10.1	58.6	64.3	S	10.4	S	S
Other engineering	5,000	55.9	37.9	30.8	7.0	32.3	46.7	6.5	9.4	5.3	6.0

[1] "Desired" sector is listed as "college or university," which may include junior colleges whereas "actual" sector is limited to "4-year colleges or universities" in the questionnaire.

[2] "Desired" sector is listed as "business/industry" whereas "actual" sector is listed as "private for-profit company or business" in the questionnaire.

[3] Includes non-profit organizations, elementary or secondary schools, those who are self-employed, and other.

[4] The actual sector is that of the principal job.

[5] This table only breaks out data for individuals who are on postdocs in colleges and universities. There are few recent S&E doctorates doing postdocs in other sectors. Overall, 18.7 percent of recent doctorates hold postdoc positions (14.4 percent in colleges and universities, 0.9 percent in business/industry, 2.3 percent in government, and 1.1 percent in other sectors).

KEY: S=Suppressed due to too few cases (fewer than 200 weighted cases).

NOTES: "Recent S&E doctorate holders" are those who earned their science and engineering doctoral degrees between June 1990 and June 1996. Recent S&E doctorate holders who were unemployed or out of the labor force are not included in this table.

SOURCE: National Science Foundation, Division of Science Resources Statistics, 1997 Survey of Doctorate Recipients

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found such employment (66.4 percent). However, a greater proportion of recent biological science doctorate holders worked in colleges and universities as postdocs (37.8 percent) than in other types of academic positions (28.6 percent).

Work Activities

When beginning their degrees, 84.6 percent of recent S&E doctorate holders reported that they wanted to conduct research after degree completion (table 2).[1] In 1997, approximately 80.6 percent of recent doctorate holders spent at least 10 percent of their typical work week on research or research-related activities. Some 48.5 percent of recent doctorate holders spent at least 10 percent of their time engaged in basic research, 62.9 percent in applied research, and 31.5 percent in development activities. In this aspect of their professional lives, recent doctorate holders appear to have

Table 2. **Desired versus actual type of work engaged by recent S&E doctorate holders: 1997**

Field of doctorate	Total, employed recent S&E doctorate holders	Research[1]					Teaching		Management[2]	
		Desired[3]	Actual[4]				Desired[3]	Actual[4]	Desired[3]	Actual[4]
			Total	Basic	Applied	Development				
		Percent								
Total, science and engineering	114,800	84.6	80.6	48.5	62.9	31.5	64.4	38.4	14.9	41.0
Sciences	90,800	83.5	78.2	51.1	58.3	23.8	66.6	42.1	14.2	40.5
Computer and mathematical sciences	8,500	87.9	81.2	51.1	56.2	27.1	75.3	52.4	5.9	26.1
Computer/information sciences	4,000	87.3	84.9	36.4	68.0	39.9	66.1	37.9	8.1	39.6
Mathematical sciences	4,500	88.5	77.9	64.2	45.7	15.6	83.6	65.5	S	14.1
Biological and agricultural sciences	26,700	93.8	85.4	68.7	61.8	17.9	65.7	36.4	14.2	43.9
Agricultural/food sciences	2,700	86.5	85.1	46.8	77.9	41.6	68.0	37.4	19.6	53.8
Biological sciences	23,200	95.0	85.5	72.2	59.3	14.9	65.2	36.4	13.0	42.6
Environmental life sciences	800	84.3	84.8	43.7	81.0	S	70.3	35.0	29.4	47.8
Health sciences	5,600	84.4	82.0	32.3	72.2	30.4	73.8	59.1	27.0	51.4
Physical and related sciences	19,700	93.9	86.4	55.8	67.2	40.0	56.0	25.8	12.5	39.7
Chemistry, except biochemistry	9,800	93.8	88.0	55.5	76.7	48.4	46.4	24.1	19.8	47.5
Earth/atmos/ocean sciences	3,200	93.2	89.5	63.5	65.2	18.3	67.5	37.0	S	39.8
Physics and astronomy	6,800	94.2	82.7	52.7	54.2	38.1	64.6	22.9	5.2	28.2
Social sciences	14,200	81.0	82.0	52.2	58.4	20.0	84.9	65.4	15.9	34.2
Economics	3,500	83.7	89.1	53.9	74.5	17.9	78.4	55.7	10.4	23.3
Political and related sciences	3,300	72.9	70.8	50.8	47.4	15.7	82.1	65.6	24.7	36.0
Sociology	2,100	89.2	86.6	56.9	57.4	16.4	90.8	78.1	18.4	30.9
Other social sciences	5,300	81.0	82.6	50.1	55.2	25.5	88.6	66.8	13.1	41.5
Psychology	16,100	53.2	49.9	22.0	37.6	13.2	57.9	39.8	15.0	45.2
Engineering	24,000	88.7	89.9	38.3	80.6	60.7	56.0	24.3	17.2	42.7
Aerospace/aeronautical engineering	900	94.4	94.4	40.6	86.3	57.7	66.8	S	S	S
Chemical engineering	2,600	90.4	93.0	39.6	89.5	74.4	39.4	18.3	17.5	50.0
Civil/architectural engineering	2,300	84.4	75.4	34.4	69.0	30.3	69.4	36.2	15.6	53.2
Electrical/computer engineering	7,100	87.5	90.4	37.5	78.8	63.5	56.4	20.9	15.6	37.7
Mechanical engineering	3,500	92.5	91.5	34.3	81.3	65.5	59.0	22.9	18.1	41.6
Materials/metallurgical engineering	2,500	90.1	95.3	44.0	86.9	76.7	42.2	14.4	17.7	45.4
Other engineering	5,000	87.2	89.7	40.3	79.1	52.6	60.9	34.2	20.0	44.7

[1] "Desired" activity is listed only as "research" whereas total "actual" activity lists more research-related activities, including development, in the questionnaire.

[2] "Desired" activity is listed as "management/administration" whereas "actual" activity is listed as "managing and supervising" in the questionnaire.

[3] "Desired" work activities are the kinds of work wanted after completing a doctoral degree.

[4] "Actual" work activities are those that occupied 10% or more time during a typical work week.

KEY: S=Suppressed due to too few cases (fewer 200 weighted cases).

NOTES: "Recent S&E doctorate holders" are those who earned their science and engineering doctoral degrees between June 1990 and June 1996. Recent doctorate holders who were unemployed or out of the labor force are not included in this table.

SOURCE: National Science Foundation, Division of Science Resources Statistics, 1997 Survey of Doctorate Recipients

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nearly realized their initial preferences. However, this is not the case for two other work activities: 64.4 percent reported that they wanted to teach when they finished their degrees whereas only 38.4 percent reported spending at least 10 percent of their typical work week teaching. Only 14.9 percent wanted to be involved in management activities at degree initiation, whereas 41.0 percent spent at least 10 percent of their time on management on their jobs in 1997. Both of these latter outcomes could be a result of the higher proportion of recent doctorate holders obtaining non-academic employment, where teaching is less likely to be a part of their jobs, and management a more likely component.

Overall Satisfaction with Doctoral Program and Current Job

Despite the differences between most desired and actual employment setting and types of work activities, recent S&E doctorate holders reported generally low levels of dissatisfaction with either their doctoral training or jobs. Among recent doctorate holders, only 6.9 percent reported being dissatisfied with their doctoral programs. Those who obtained employment in their desired sector were less likely to be dissatisfied (4.7 percent) with their doctoral programs than those who did not (9.6 percent). Similarly, there was very little dissatisfaction among all doctorate holders with their jobs. However, recent doctorate holders were shown to have slightly higher job dissatisfaction (12.5 percent) than the older group who obtained their doctorates prior to 1990 (9.7 percent). Job dissatisfaction was also slightly higher for recent doctorate holders who did not obtain employment in their desired sector (14.5 percent) than those who did (11.1 percent).

Why do the desired goals and outcomes of recent doctorate holders differ? Some explanations could be: (1) Research-oriented doctoral degree programs at U.S. universities train students to become independent researchers, with the attainment of an academic position being one of the strongest indicators of success. Therefore, it is not surprising that aspiring doctoral candidates desired that goal upon entering the doctoral program. (2) Recent doctorate holders may not have a realistic view of labor market conditions, particularly in the absence of contradictory data. For example, many institutions do not have outcome information on past graduates. Therefore, those enrolled in doctoral programs have little access to informaton on the full range of employment opportunities that may be available to them outside academia. (3) The median time to degree for the recent doctorates mentioned here was between 6.5 (for 1990 graduates) to 6.9 years (for 1996 graduates).[6] Over this time frame, doctoral candidates' preferences may have changed, as well as labor market conditions. Each of these factors may contribute to the differences between career preferences at the beginning of their doctoral programs and postgraduation employment outcomes of recent S&E doctorate holders. Further exploration of these issues can be done using the Survey of Doctorate Recipients data.

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[6] "Time to degree" as used here is defined as the number of years actually registered in a doctoral program. These data were obtained from the Survey of Earned Doctorates.

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